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NOTES ON GEOGRAPHIC DISTRIBUTION

First record of the alien gecko *Lepidodactylus lugubris* (Duméril & Bibron, 1836) (Gekkonidae) in the Cabo Blanco Absolute Natural Reserve, Costa Rica

Matteo Dal Zotto[1, 2], Giuseppe Romeo[2], Francesco Saponi[1], Tommaso Toldo[1, 2, 3], Andrea Vaccari[1, 2, 3]

1 *Department of Life Sciences, University of Modena and Reggio Emilia, Modena, Italy*
2 *Association Foreste per Sempre ODV, Modena, Italy*
3 *Italian Gekko Association APS, Reggio Emilia, Italy*

Corresponding author: *Matteo Dal Zotto (matteo.dalzotto@unimore.it)*

Abstract. *Lepidodactylus lugubris* (Duméril & Bibron, 1836) is a parthenogenetic gekkonid originally distributed in southeast Asia but introduced to numerous countries worldwide. Its geographic range is expanding in several tropical regions due to anthropogenic activities. Here we report the first presence data for this species from the Reserva Natural Absoluta Cabo Blanco in northwestern Costa Rica. Our in-situ observation provides evidence that the geographic range of *L. lugubris* is expanding northwards along the Pacific slope of Costa Rica and, more generally, of Central America.

Key words. Alien species, Central America, Gekkota, herpetofauna, neotropics, reptiles

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INTRODUCTION

The Mourning Gecko *Lepidodactylus lugubris* (Duméril & Bibron, 1836) is a small-bodied species belonging to the family Gekkonidae. This gecko is nocturnal, has scansorial habits (Griffing et al. 2018), and normally feeds on arthropods but also on fruit and nectar, especially in captivity (Savage 2002; Leenders 2019). Its original distribution includes islands and coastal areas of continental Southeast Asia and Oceania (Yamashiro et al. 2000; Zug 2013; Uetz et al. 2023), but it has been introduced to various regions of Central and South America and the Caribbean (Krysko et al. 2011; Hoogmoed and Avila-Pires 2015). This species is synanthropic, frequently found in or near buildings. Human activities, such as intercontinental trade, drove its introduction to the Neotropics (Hoogmoed and Avila-Pires 2015; Krysko and MacKenzie-Krysko 2016). In Costa Rica, *L. lugubris* has expanded its geographic distribution since it was first reported in the 1970s (Jiménez and Abarca 2015), and it is now diffused in the southern coastal lowlands on both the Pacific and Atlantic slopes (Savage 2002; Abarca et al. 2009; Señaris et al. 2017; Leenders 2019). Here we document the occurrence of *L. lugubris* in northwestern Costa Rica and report for the first time its presence within a strictly protected area of the country.

Furthermore, since no effort has yet been made to investigate the expansion of the geographic distribution of *L. lugubris* in Costa Rica (Savage 2002; Sasa et al. 2009; Bolaños et al. 2011), we also review published and unpublished records to determine this species' distribution. We hope that this will help with the management of this alien species.

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METHODS

We led a three-day herpetological survey of the Reserva Natural Absoluta Cabo Blanco (Cabo Blanco Absolute Natural Reserve: RNACB), which is a protected area of approximately 1170 ha located at the southwestern end of the Nicoya Peninsula in northwestern Costa Rica. The Reserve, which is currently managed by the Sistema Nacional de Áreas de Conservación, was created in 1963 and represents the first protected area in the history of Costa Rica, a country known worldwide for its efforts to conserve biodiversity (Dal Zotto et al. 2017).

A specimen of *Lepidodactylus lugubris* was caught by hand during our survey; it was photographed, identified in the field basing on Savage (2002), Zug (2013), and Leenders (2019), and then released. The ultraviolet response of this specimen was gained using a TATTU U3S UV-torch with a peakemission of 365 nm (Prötzel et al. 2021). Our study was undertaken in a cooperation with the Costa Rica Sistema Nacional de Áreas de Conservación (SINAC). Photographic vouchers have been deposited in the Department of Life Sciences, University of Modena and Reggio Emilia, Italy.

RESULTS

***Lepidodactylus lugubris* (Duméril & Bibron, 1836)**
Figure 1

New record (Figure 2). COSTA RICA – **Malpais** • Reserva Natural Absoluta Cabo Blanco; 09°33′29″N, 085°06′
40″W; 5 m a.s.l.; 31.I.2023; A. Vaccari obs.; 1 ♀, UNIMORE-DSV 1-0005 to 1-0009.

Identification. A single specimen of *L. lugubris* was found approximately one hour after sunset (6:45 p.m.). The gecko was active on the wall of a lodge at the Estación Biológica San Miguel. The specimen (Figure 1) matched the morphological descriptions by Savage (2002) and Zug (2013). We checked the general conditions of the animal and detected two eggs in the lower abdomen—clearly visible through the skin—and prominent calcium sacs at the base of the neck, which are typical of a full-grown female (Figure 1B). We also tested the ultraviolet light response of the gecko. The examination showed no dermal fluorescence, but the skull, along with joints of arms and limbs fluoresced.

DISCUSSION

The herpetofauna of the RNACB has been investigated by Laurencio (2009), who reported a 19 reptile species. Interestingly, the only Gekkota found were autochthonous species: *Gonatodes albogularis* (Duméril & Bibron, 1836) (Sphaerodactylidae) and *Phyllodactylus tuberculosus* (Wiegmann, 1834) (Phyllodactylidae), while no exotic geckos were recorded. Since the introduced species reported by us is easily

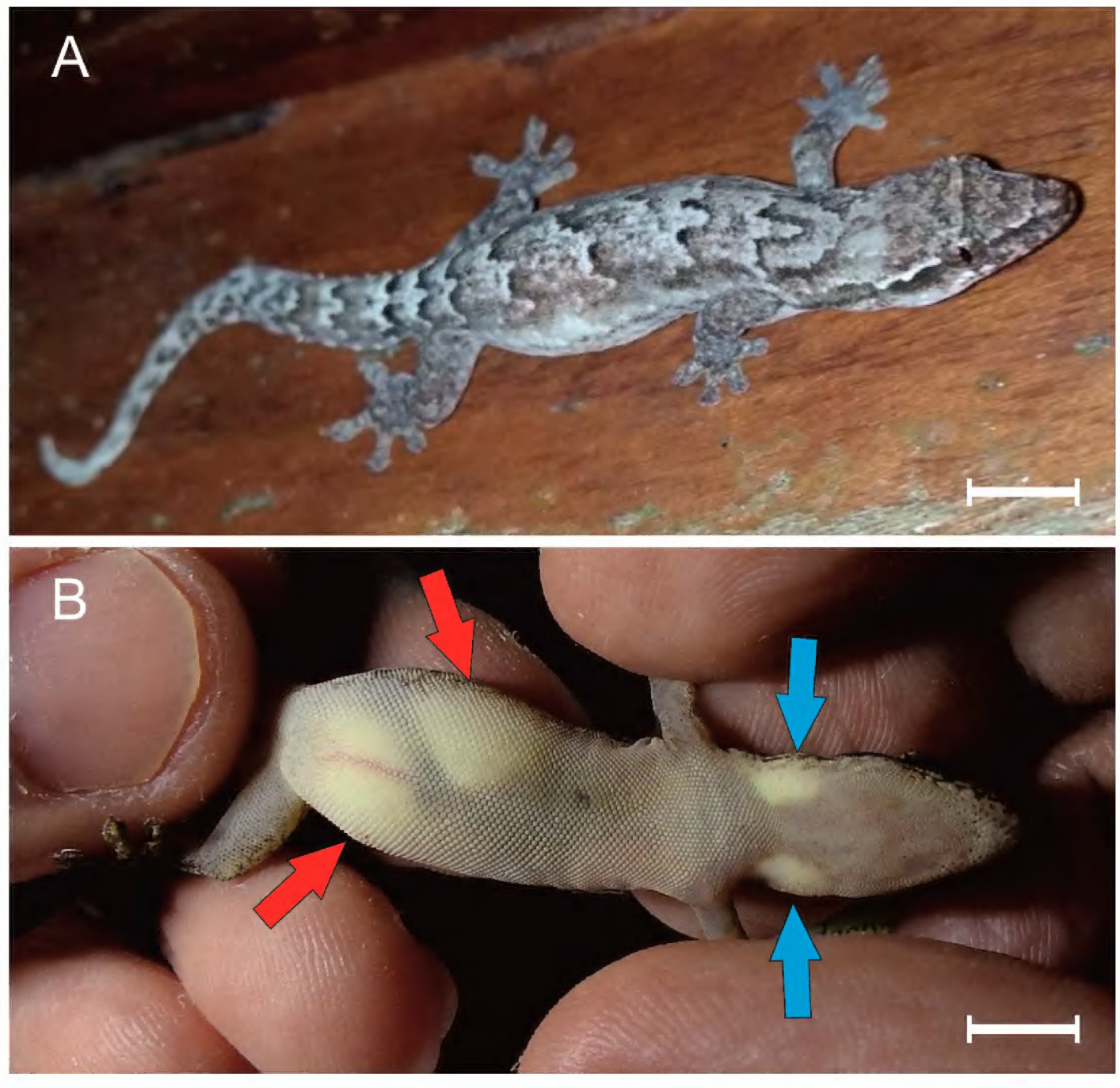

Figure 1. *Lepidodactylus lugubris* from the Reserva Natural Absoluta Cabo Blanco, Costa Rica. **A.** Habitus. **B.** Ventral view with eggs (red arrows) and calcium sacs (blue arrows). Scale bar: 1 cm. Photographs by Andrea Vaccari (A) and Matteo Dal Zotto (B).

Figure 2. A. Records of *Lepidodactylus lugubris* in the Nicoya Peninsula, Costa Rica. Yellow dot: report from the Reserva Natural Absoluta Cabo Blanco (present survey); red dots: reports from iNaturalist and GBIF; aquamarine dots: mistaken reports from iNaturalist. **B.** Records from Central America derived from iNaturalist and GBIF. White square = location of the Nicoya Peninsula, Costa Rica; red areas and dots = previously known distribution; yellow dots (within square): new records (2020–2023).

distinguishable, we have no doubt that *L. lugubris* was absent in the RNACB at the time of Laurencio's (2009) study. In the literature, this species is reported in northwestern Costa Rica from a single isolated inland location near Rincón de la Vieja, Guanacaste (Jiménez and Abarca 2015). We checked 10 records of this species in iNaturalist (2023) and the Global Biodiversity Information Facility (GBIF 2023), dating from 2020 to 2023, to better understand the actual presence of *L. lugubris* on the Nicoya Peninsula. We discovered that three records were mistaken and are instead *Hemidactylus frenatus* (Duméril & Bibron, 1836), while the remaining records are from outside the RNACB (Figure 2A). Altogether, this information proves the presence of *L. lugubris* in northwestern Costa Rica.

Widening the focus to the whole of the Pacific slope of Central America, *L. lugubris* is known to occur from southwestern Panama to northwestern Costa Rica and along coastal central Mexico in the area around Puerto Vallarta (Figure 2B; iNaturalist 2023; Uetz et al. 2023). This species' expansion in Pacific Central America appears very recent, as the available data from northwestern Costa Rica and from central Mexico are from 2020 to present. Apparently, Puerto Vallarta may be a nucleus of possible spread, but it is worth noting that the main colonization of the Pacific slope of Central America appears to follow a south–north gradient, and northwestern Costa Rica seems to represent the latest area invaded by *L. lugubris*. Given this, we hope that future investigations will shed light on the occurrence of this species elsewhere in Central

America, especially to the north of Costa Rica.

We report also the occurrence along with *L. lugubris* of a second gekkonid within the RNACB: the Common House Gecko *Hemidactylus frenatus* Duméril & Bibron, 1836 (iNaturalist 2023; direct observations by some of us). While *L. lugubris* started its colonization of Costa Rica at least in 1970, *H. frenatus* entered Costa Rica almost 20 years later, around 1990 (Savage 2002). Notwithstanding this late start, *H. frenatus* has now colonized most of Costa Rica and Central America (Uetz et al. 2023), while *L. lugubris* remains rather restricted in Costa Rica and Central America. There is evidence that *H. frenatus* interacts directly and indirectly with *L. lugubris*, for example, it predates juveniles and induces stress (Brown et al. 2022). These interactions could be a reason that has limited the establishment and expansion of *L. lugubris* in areas primary populated by *H. frenatus*. We think it worthwhile to determine if these interactions also occur within the RNACB and in other areas of recent colonization. This information could be relevant for better foreseeing the dynamics of the progressive expansion of *L. lugubris*.

We feel that a study of the potential negative effects of these two alien species on the native *P. tuberculosus* is important. *P. tuberculosus* is included in the official checklist of endangered species by the Sistema Nacional de Áreas de Conservación (SINAC 2017), and whose local population is at major risk of disappearance as the RNACB represents one of the locations at the southernmost border of its range (Laurencio 2009; Leenders 2019). Since many populations of *L. lugubris* are parthenogenetic (Leenders 2019), even a single female can succeed at colonizing an area, and thus the finding of only one individual in the RNACB can be interpreted as a sign of early colonization of this protected area. For these reasons, further surveys are needed to better understand the dispersal of this alien species and its impact on the native Costa Rica herpetofauna.

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ADDITIONAL INFORMATION

Conflict of interest

The authors declare that no competing interests exist.

Ethical statement

No ethical statement is reported.

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Author contributions

Conceptualization: AV, MD, GR, TT. Data curation: AV, MD, FS. Formal analysis: AV, MD. Investigation: AV, MD, GR, TT. Methodology: AV, MD, FS. Resources: MD. Supervision: MD. Project administration: MD. Software: FS. Validation: MD. Writing – original draft: AV, MD, GR, FS. Writing – review and editing: MD, TT.

Author ORCIDs

Matteo Dal Zotto https://orcid.org/0000-0003-1386-7626
Francesco Saponi https://orcid.org/0009-0007-3302-9976
Andrea Vaccari: https://orcid.org/0009-0006-9782-8219

Data availability

All data that support the findings of this study are available in the main text.

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